

## CHAPTER 80 APPLICATION OF DESIGN STANDARDS

### Topic 81 - Project Development Overview

#### Index 81.1 - Philosophy

The Project Development process seeks to provide a degree of mobility to users of the transportation system that is in balance with other values. In the development of transportation projects, social, economic, and environmental effects must be considered fully along with technical issues so that final decisions are made in the best overall public interest. Attention should be given to such considerations as:

- (a) Need for safe and efficient transportation.
- (b) Attainment of community goals and objectives.
- (c) Needs of low mobility and disadvantaged groups.
- (d) Costs of eliminating or minimizing adverse effects on natural resources, environmental values, public services, aesthetic values, and community and individual integrity.
- (e) Planning based on realistic financial estimates.
- (f) The cost, ease, and safety of maintaining whatever is built.

Proper consideration of these items requires that a facility be viewed from the perspectives of the user, the nearby community, and larger statewide interests. For the user, efficient travel and safety are paramount concerns. At the same time, the community often is more concerned about local aesthetic, social, and economic impacts. The general population, however, tends to be interested in how successfully a project functions as part of the overall transportation system and how large a share of available capital resources it consumes. Therefore, individual projects must be selected

for construction on the basis of overall system benefits as well as community goals, plans, and values.

Decisions must also emphasize different transportation modes working together effectively.

The goal is to increase highway mobility and safety in a manner that is compatible with, or which enhances, adjacent community values and plans.

### Topic 82 - Application of Standards

#### 82.1 Highway Design Manual Standards

- (1) *General.* The highway design criteria and policies in this manual provide a guide for the engineer to exercise sound judgment in applying standards, consistent with the above Project Development philosophy, in the design of projects.

The design standards used for any project should equal or exceed the minimum given in the Manual to the maximum extent feasible, taking into account costs, traffic volumes, traffic and safety benefits, right of way, socio-economic and environmental impacts, etc. The philosophy provides for use of lower standards when such use best satisfies the concerns of a given situation. Because design standards have evolved over many years, many existing highways do not conform fully with current standards. It is not intended that current manual standards be applied retroactively to all existing State highways; such is neither warranted nor economically feasible. However, when warranted, upgrading of existing roadway features such as guardrail, lighting, superelevation, roadbed width, etc., should be considered, either as independent projects or as part of larger projects. A record of the decision not to upgrade the existing non-standard mandatory features shall be provided through the exception process (See Index 82.2).

This manual does not address temporary construction features. It is recognized that the construction conditions encountered are so diverse and variable that it is not practical to set geometric criteria. Guidance for the treatment of temporary construction zones can be found in Chapter 5 of the Traffic Manual, "Manual of Traffic Control" and the Manual on Uniform Traffic Control Devices (MUTCD).

In this manual design standards are categorized in order of importance in development of a safe State highway system operating at selected levels of service commensurate with projected traffic volumes and highway classification.

- (2) *Mandatory Standards.* Mandatory design standards are those considered most essential to achievement of overall design objectives. Many pertain to requirements of law or regulations such as those embodied in the FHWA's 13 controlling criteria (see below). Mandatory standards use the word "shall" and are printed in **Boldface** type (see Table 82.1A).
- (3) *Advisory Standards.* Advisory design standards are important also, but allow greater flexibility in application to accommodate design constraints or be compatible with local conditions on resurfacing or rehabilitation projects. Advisory standards use the word "should" and are indicated by Underlining (see Table 82.1B).
- (4) *Permissive Standards.* All standards other than mandatory or advisory, whether indicated by the use of "should" or "may", are permissive with no requirement for application intended.
- (5) *Controlling Criteria.* The FHWA has designated thirteen controlling criteria for selection of design standards of primary importance for highway safety, listed as follows: design speed, lane width, shoulder width, bridge width, horizontal alignment, vertical alignment, grade, stopping sight distance, cross slope, superelevation, horizontal clearance, vertical clearance and bridge structural

capacity. All but the last of these criteria are also designated as geometric criteria.

The design standards related to the 12 geometric criteria are designated as mandatory standards in this manual (see Index 82.1(2) and Table 82.1A).

- (6) *Other.* In addition to the design standards in this manual, the Traffic Manual contains standards relating to clearzone, signs, delineation, barrier systems, signals, and lighting.

Caution must be exercised when using other Caltrans publications which provide guidelines for the design of highway facilities, such as HOV lanes. These publications do not contain design standards; moreover, the designs suggested in these publications do not always meet Highway Design Manual Standards. Therefore, all other Caltrans publications must be used in conjunction with this manual.

## 82.2 Approvals for Nonstandard Design

- (1) *Mandatory Standards.* **To promote uniform practice on a statewide basis, design features or elements which deviate from the mandatory standards indicated herein shall require the approval of the Chief, Division of Design. This approval authority has been delegated to the Project Development Coordinators.**

The current procedures and documentation requirements pertaining to the approval process for exceptions to mandatory design standards are contained in Chapter 21 of the Project Development Procedures Manual (PDPM).

Design exception approval must be obtained prior to District approval of the PSR, or any project initiation document (i.e., PSSR, PEER, combined PSR/PR), other than the PSR-PDS. The text of the project initiation report must include a brief description of the nonstandard features, as well as a reference to all approved Fact Sheets and their approval dates by the Division of Design and/or FHWA (when applicable).

If the need for a design exception is identified after approval of the project's initiation report, the above described consultation and documentation process shall be initiated immediately, and must be completed prior to reaching the next project milestone. The text of the engineering report associated with the next project milestone (i.e., Project Report, Supplemental PR, PAR, etc.) must include the design exception reference normally provided in the project initiation report (see above).

During the construction phase of a project, Fact Sheets must be prepared (by Project Development staff) to document any nonstandard features proposed in a Contract Change Order. Such Change Orders shall not be executed until the proposed design exception has been approved (at least verbally) by the appropriate Caltrans and FHWA (if required) authority (ies). If verbal approval is granted to expedite Change Order execution, the Fact Sheet must be completed and approved immediately thereafter.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) allows significant delegation to the states by FHWA to approve and administer portions of the Federal-Aid Transportation Program. California has accepted the maximum delegations offered as outlined in the May 27, 1992 memorandum signed by W.P. Smith. If required, FHWA approval of exceptions to mandatory design standards related to the 13 controlling criteria should be sought as early in the project development process as possible. However, formal approval shall not be requested until the appropriate Project Development Coordinator has approved the design exception.

FHWA approval is not required for exceptions to "Caltrans-only" mandatory standards. Table 82.1A identifies these mandatory standards.

For local facilities crossing the State right of way see Index 308.1.

- (2) *Advisory Standards.* The authority to approve exceptions to advisory standards has been delegated to the District Directors. Proposals for exceptions from advisory standards should be discussed with the Project Development Coordinators during development of the approval documentation. The responsibility for the establishment of procedures for review, documentation, and long term retention of approved exceptions from advisory standards has also been delegated to the District Directors.

### 82.3 Use of FHWA and AASHTO Standards and Policies

The standards in this manual generally conform to the standards and policies set forth in the AASHTO publication, "A Policy on Geometric Design of Highways and Streets" (1994) and "A Policy on Design Standards-Interstate System" (1988). A third AASHTO publication "Roadside Design Guide" (1996) focuses on creating safer roadsides. These three documents, along with other AASHTO & FHWA publications cited in 23 CFR Ch 1, Part 625, Appendix A, contain most of the current AASHTO policies and standards, and are approved references to be used in conjunction with this manual.

AASHTO policies and standards, which are established as nationwide standards, do not always satisfy California conditions. When standards differ, the instructions in this manual govern, except when necessary for FHWA project approval (Index 108.3, Coordination with the FHWA).

### 82.4 Mandatory Procedural Requirements

Required procedures and policies for which Caltrans is responsible, relating to project clearances, permits, licenses, required tests, documentation, value engineering, etc., are indicated by use of the word "must". Procedures and actions to be performed by others (subject to notification by Caltrans), or statements of fact are indicated by the word "will".

### **82.5 Effective Date for Implementing Revisions to Design Standards**

Revisions to design standards will be issued with a stated effective date. It is understood that all projects will be designed to current standards unless an exception has been approved in accordance with Index 82.2.

On projects where the project development process has started, the following conditions on the effective date of the new or revised standards will be applied:

- For all projects where the PS&E has not been finalized, the new or revised design standards shall be incorporated unless this would impose a significant delay in the project schedule or a significant increase in the project engineering or construction costs. The Project Development Coordinator will make the final determination on whether to apply the new or previous design standards on a project-by-project basis for roadway features.
- For all projects where the PS&E has been submitted to Headquarters Office Engineer for advertising or the project is under construction, the new or revised standards will be incorporated only if they are identified in the Change Transmittal as requiring special implementation.

For locally-sponsored projects, the Oversight Engineer shall inform the funding sponsor within 15 working days of the effective date of any changes in mandatory or advisory design standards as defined in Index 82.2.

Table 82.1A

## Mandatory Standards

<b>CHAPTER 80</b>			<b>APPLICATION OF DESIGN STANDARDS</b>			<b>Topic 205</b>			<b>Road Connections and Driveways</b>											
<b>Topic 82</b>			Application of Standards						Index 205.1			Sight Distance Requirements for Access Openings on Expressways								
Index 82.2			Approvals for Nonstandard Design																	
<b>CHAPTER 100</b>			<b>BASIC DESIGN POLICIES</b>						<b>Topic 208</b>			<b>Bridges and Grade Separation Structures</b>								
<b>Topic 101</b>			<b>Design Speed</b>						Index 208.1			Bridge Width								
Index 101.1			Technical Reductions of Design Speed						208.10			Bridge Approach Railings*								
			101.1						Selection of Design Speed - Local Facilities											
			101.1						Selection of Design Speed - Local Facilities - with Connections to State Facilities											
			101.2						Design Speed Standards											
<b>Topic 104</b>			<b>Control of Access</b>																	
Index 104.4			Protection of Access Rights*						<b>CHAPTER 300</b>						<b>GEOMETRIC CROSS SECTION</b>					
<b>CHAPTER 200</b>			<b>GEOMETRIC DESIGN AND STRUCTURE STANDARDS</b>						<b>Topic 301</b>			<b>Pavement Standards</b>								
<b>Topic 201</b>			<b>Sight Distance</b>						Index 301.1			Lane Width								
Index 201.1			Sight Distance Standards						301.2			Cross Slopes								
<b>Topic 202</b>			<b>Superelevation</b>						301.2			Algebraic Differences in Cross Slopes								
Index 202.2			Standards for Superelevation						<b>Topic 302</b>			<b>Shoulder Standards</b>								
202.7			Superelevation on City Streets and County Roads						Index 302.1			Shoulder Width								
<b>Topic 203</b>			<b>Horizontal Alignment</b>						302.2			Shoulder Cross Slopes								
Index 203.1			Horizontal Alignment - Local Facilities						<b>Topic 305</b>			<b>Median Standards</b>								
			203.1						Index 305.1			Median Width*								
			203.1						<b>Topic 307</b>			<b>Cross Sections for State Highways</b>								
			203.2						Index 307.2			Shoulder Width for Structural Section Support on Two-lane Cross Sections for New Construction								
<b>Topic 204</b>			<b>Grade</b>						307.2			Shoulder Standards for Two-lane Cross Sections for New Construction								
Index 204.1			Standards for Grade - Local Facilities						307.3			Two-lane Cross Sections for RRR Projects -Roadbed Width								
			204.3						307.3			Two-lane Cross Sections for RRR Projects - Bridge Width								
			204.8						307.3			Bridge Rail and Guardrail on RRR Projects								
									<b>Topic 308</b>			<b>Cross Sections for Roads Under Other Jurisdictions</b>								
									Index 308.1			Cross Section Standards for City Streets and County Roads without Connection to State Facilities								

\* Caltrans-only Mandatory Standard

**Table 82.1A****Mandatory Standards (Cont.)**

Topic 309	Clearances	308.1	Minimum Width of 2-lane Structures for City Streets and County Roads without Connection to State Facilities	405.2	Left-turn Channelization - Lane Width
				405.2	Two-way Left-turn Lane Width
		308.1	Cross Section Standards for City Streets and County Roads with Connection to State Facilities	405.3	Right-turn Channelization - Width
		CHAPTER 500		TRAFFIC INTERCHANGES	
		Topic 501		General	
		Index	501.3	Interchange Spacing	
		Topic 504		Interchange Design Standards	
		Index	504.2	Location of Freeway Entrances & Exits	
			504.2	Ramp Deceleration Lane and “DL” Distance	
			504.3	Ramp Lane Width	
	504.3	Ramp Shoulder Width			
	504.3	Ramp Lane Drop Taper			
	504.3	Ramp Metering Design Features			
	504.3	Lane Drop Taper			
	504.3	Ramp Meters on Connector Ramps			
	504.3	Lane Drop Transitions on Connector Ramps			
	504.3	Distance Between Ramp Intersection and Local Road Intersection			
	504.4	Freeway-to-freeway Connections - Shoulder Width			
	504.8	Access Control along Ramps			
	504.8	Access Control at Ramp Terminal			
	504.8	Access Rights Required Opposite Ramp Terminals			
Topic 310		Frontage Roads			
Index	310.1	Frontage Road Width*			
CHAPTER 400		INTERSECTIONS AT GRADE			
Topic 405		Intersection Design Standards			
Index	405.1	Driver Set Back			
	405.1	Sight Distance at Public Road Intersections			
	405.1	Sight Distance at Private Road Intersections			
CHAPTER 700		MISCELLANEOUS STANDARDS			
Topic 701		Fences			
	Index	701.2	Fences on Freeways and Expressways*		

**Table 82.1A**  
**Mandatory Standards (Cont.)**

<b>CHAPTER 900</b>		<b>LANDSCAPE ARCHITECTURE</b>	1003.2	Class II Bikeways Adjacent to Parking*	
<b>Topic 903</b>		<b>Safety Roadside Rest Area Design Standards</b>	1003.2	Class II Bikeway Widths where Parking is Permitted*	
Index	903.5	Rest Area Ramp Design	1003.2	Class II Bikeway Widths where Parking is Prohibited*	
<b>Topic 904</b>		<b>Vista Point Standards and Guidelines</b>	1003.2	Class II Bikeways Adjacent to Part-time Parking*	
Index	904.3	Vista Point Ramp Design	1003.2	Class II Bikeways Widths in Undeveloped Areas*	
<b>CHAPTER 1000</b>		<b>BIKEWAY PLANNING AND DESIGN</b>	1003.2	Class II Bikeways Delineation*	
<b>Topic 1002</b>		<b>General Planning Criteria</b>	1003.2	Class II Bikeways Through Interchange*	
Index	1002.1	Resurfacing Requirements*	1003.3	Class III Bikeways Through Interchange*	
	1002.1	Shoulder Requirements when Adding Lanes*	1003.6	Bicycles Traveling against Traffic*	
<b>Topic 1003</b>		<b>Design Criteria</b>	1003.6	Bikeway Overcrossing Structures*	
Index	1003.1	Class I Bikeway Widths*	1003.6	Drainage Inlet Grates on Bikeways*	
	1003.1	Class I Bikeway Horizontal Clearance*	<b>Topic 1004</b>	<b>Uniform Signs, Markings and Traffic Control Devices</b>	
	1003.1	Class I Bikeway Structure Width*			
	1003.1	Class I Bikeway Vertical Clearance*			
	1003.1	Physical Barriers Adjacent to Class I Bikeways			
	1003.1	Class I Bikeway in Medians*			
	1003.1	Class I Bikeway Design Speeds*	Index	1004.1	Uniform Signs, Markings and Traffic Control Devices*
	1003.1	No Speed Bumps on Class I Bikeways*	1004.3	Class II Bikeway Signing*	
	1003.1	Class I Bikeway in Medians*	1004.3	Class II Bikeway Pavement Markings*	
	1003.1	Class I Bikeway Design Speeds*	1004.3	Class II Bikeway Pavement Markers*	
	1003.1	No Speed Bumps on Class I Bikeways*	<b>CHAPTER 1100</b>		
	1003.2	Class II Bikeway Design*	<b>HIGHWAY TRAFFIC NOISE ABATEMENT</b>		
	1003.2	Class II Bikeway Widths Adjacent to Parking Stalls*	<b>Topic 1102</b>	<b>Design Criteria</b>	
			Index	1102.2	Horizontal Clearance to Noise Barrier
				1102.2	Noise Barrier on Safety Shape Concrete Barrier

\* Caltrans-only Mandatory Standard

**Table 82.1B**  
**Advisory Standards**

CHAPTER 100			BASIC DESIGN POLICIES		202.7	Superelevation on City Streets and County Roads		
Topic 101			Design Speed		Topic 203		Horizontal Alignment	
	Index	101.1	Selection of Design Speed - Local Facilities		Index	203.1	Horizontal Alignment - Local Facilities	
		101.1	Selection of Design Speed - Local Facilities - with Connections to State Facilities			203.3	Alignment Consistency and Design Speed	
Topic 104			Control of Access			203.5	Compound Curves	
	Index	104.5	Relation of Access Opening to Median Opening			203.6	Reversing Curves	
Topic 105			Pedestrian Facilities		Topic 204		Grade	
	Index	105.1	Minimum Sidewalk Width		Index	204.1	Standards for Grade - Local Facilities	
		105.4	Access at Bridges and Curbs			204.3	Standards for Grade	
		105.4	New Construction, Two Ramp Design			204.3	Ramp Grades	
		105.4	Location of Curb Ramps			204.4	Vertical Curves	
Topic 107			Roadside Installations			204.5	Decision Sight Distance at Climbing Lane Drops	
	Index	107.1	Standards for Roadway Connections			204.6	Design Speeds for Horizontal and Vertical Curves	
		107.1	Number of Exits and Entrances Allowed at Roadway Connections			204.8	Falsework Span and Depth Requirements	
CHAPTER 200			GEOMETRIC DESIGN AND STRUCTURE STANDARDS		Topic 205		Road Connections and Driveways	
Topic 201			Sight Distance			Index	205.1	Access Openings on Expressways
	Index	201.3	Stopping Sight Distance on Grades		Topic 206		Pavement Transitions	
		201.7	Decision Sight Distance		Index	206.3	Lane Drop Transitions	
Topic 202			Superelevation			206.3	Lane Width Reductions	
	Index	202.2	Superelevation on Same Plane for Rural Two-lane Roads		Topic 208		Bridges and Grade Separation Structures	
		202.5	Superelevation Transition		Index	208.3	Decking of Bridge Medians	
		202.5	Superelevation Runoff			208.6	Minimum Width of Pedestrian Overcrossings	
		202.5	Superelevation in Restrictive Situations			208.6	Ramp Requirements on Pedestrian Separation Structures	
		202.6	Superelevation of Compound Curves			208.10	Protective Screening on Overcrossings	
						208.10	Bicycle Railing Locations	



**Table 82.1B**  
**Advisory Standards (Cont.)**

<b>Topic 209</b>	<b>Curbs and Gutters</b>	<b>Topic 404</b>	<b>Design Vehicles</b>
Index 209.1	Use of Curbs	Index 404.3	STAA Truck-turn Template
<b>Topic 210</b>	<b>Earth Retaining Systems</b>	404.3	California Truck-turn Template
Index 210.5	Cable Railing	<b>Topic 405</b>	<b>Intersection Design Standards</b>
<b>CHAPTER 300</b>	<b>GEOMETRIC CROSS SECTION</b>	Index 405.1	Corner Sight Distance at Public Road Intersections
<b>Topic 301</b>	<b>Pavement Standards</b>	405.1	Decision Sight Distance at Intersections
Index 301.2	Algebraic Differences of Cross Slopes	405.5	Emergency Openings and Sight Distance
<b>Topic 304</b>	<b>Side Slopes</b>	405.5	Median Opening Locations
Index 304.1	Side Slope Standards	<b>CHAPTER 500</b>	<b>TRAFFIC INTERCHANGES</b>
<b>Topic 305</b>	<b>Median Standards</b>	<b>Topic 502</b>	<b>Interchange Types</b>
Index 305.1	Median Width	Index 502.2	Isolated Ramps and Partial Interchanges
305.2	Median Cross Slopes	<b>Topic 504</b>	<b>Interchange Design Standards</b>
305.4	Median Curbs	Index 504.2	Freeway Entrance and Exit Design
<b>Topic 308</b>	<b>Cross Sections for Roads Under Other Jurisdiction</b>	504.2	Collector-distributor Deceleration Lane and "DL" Distance
Index 308.1	Cross Section Standards for City Streets and County Roads without Connection to State Facilities	504.2	Paved Width at Gore
308.1	Minimum Shoulder Width Requirements for Bicycles	504.2	Auxiliary Lanes
<b>Topic 309</b>	<b>Clearances</b>	504.2	Freeway Exit Design Speed
Index 309.1	Clear Recovery Zone	504.2	Decision Sight Distance at Exits
309.1	Safety Shaped Barriers at Retaining, Pier, or Abutment Walls	504.2	Design Speed and Alignment Consistency at Inlet Nose
309.5	Structures Across or Adjacent to Railroads - Vertical Clearance	504.2	Freeway Ramp Grades
<b>Topic 310</b>	<b>Frontage Roads</b>	504.2	Differences in Pavement Cross Slopes at Freeway Entrances and Exits
Index 310.2	Outer Separation - Urban Areas	504.2	Vertical Curves at Freeway Exits
310.2	Outer Separation - Rural Areas	504.2	Crest Vertical Curves at Freeway Exit Terminus
<b>CHAPTER 400</b>	<b>INTERSECTIONS AT GRADE</b>	504.2	Sag Vertical Curves at Freeway Exit Terminus
<b>Topic 403</b>	<b>Principles of Channelization</b>	504.2	Ascending Entrance Ramps with Sustained Upgrades
Index 403.3	Angle of Intersection		

**Table 82.1B**  
**Advisory Standards (Cont.)**

504.3	Ramp Design Speed	504.5	Auxiliary Lanes
504.3	Ramp Lane Drop Taper	504.6	Mainline Lane Reduction at Interchanges
504.3	Ramp Lane Drops and Auxiliary Lanes	504.7	Weaving Sections
504.3	Metered Single-Lane Entrance Ramps Auxiliary Lane	504.7	Weaving Length
504.3	Metered Multi-Lane Entrance Ramps Auxiliary Lane	504.8	Access Control at Ramp Terminal
504.3	Ramp Terminals and Grade	<b>CHAPTER 700 MISCELLANEOUS STANDARDS</b>	
504.3	Ramp Terminals and Sight Distance	<b>Topic 701</b>	<b>Fences</b>
504.3	Free Right Turns at Ramp Terminals	Index 701.2	Fences on Freeways and Expressways
504.3	Distance between Ramp Intersection and Local Road Intersection	<b>CHAPTER 900 LANDSCAPE ARCHITECTURE</b>	
504.3	Entrance Ramp Lane Drop	<b>Topic 902</b>	<b>Planting design standards</b>
504.3	Single-Lane Ramp Widening for Passing	Index 902.2	Sight Distance and Safety Requirements for Planting
504.3	Two-lane Exit Ramps	902.2	Clear Recovery Zone and Trees
504.3	Two-lane Exit Ramps and Auxiliary Lanes	902.2	Minimum Setback of Trees
504.3	Distance Between Successive On-ramps	<b>Topic 904</b>	<b>Vista Point Design Standards</b>
504.3	Distance Between Successive Exits	Index 904.3	Vista Point Connection Design
504.4	Freeway-to-freeway Connections Design Speed		
504.4	Profile Grades on Freeway-to-freeway Connectors		
504.4	Single-lane Connector Design		
504.4	Single-lane Connector Widening for Passing		
504.4	Volumes Requiring Branch Connectors		
504.4	Merging Branch Connector Design		
504.4	Diverging Branch Connector Design		
504.4	Merging Branch Connector Auxiliary Lanes		
504.4	Diverging Branch Connector Auxiliary Lanes		
504.4	Freeway-to-freeway Connector Lane Drop Tapers		